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QUALITY ANALYSIS OF COPRA DRIED AT DIFFERENT DRYING AIR TEMPERATURES

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ABSTRACT

Copra is one of the major traditional products processed from coconuts. Traditionally drying is done either using a kiln or under direct sun to reduce moisture content of the coconut meat which requires long drying period and also produces poor quality copra. Cabinet drying experiments were conducted to reduce the drying time by investigating the quality of copra at different drying air temperatures (60, 70, 80 and 90^{o}C). Copra was dried from the initial moisture content of 52 % (w.b) to the required moisture content of 6.1 % (w.b). It produces 75 % milling copra grade 1 (MCG1) at 70 ^{o}C in 24 h. In open sun drying to reduce the moisture content of 52.3% (w.b.) to about 6.8 % it required 105 h with an average of 51 % MCG1**.**

KEYWORDS: Copra, Peroxide Value, Milling Copra, Sun Drying, Cabinet Dryer

INTRODUCTION

India is the third largest coconut producing country covering 15.5% of world coconut cultivated area that accounts for 21% of world coconut production. It annually produces 14.81 billion nuts from an area of 1.93 million ha. In this about 30% of coconut production goes for producing copra for oil extraction. Copra is the richest source of oil (70%). For copra oil extraction, moisture content (52% wet basis) in fresh coconuts is required to be reduced to 7 % by drying to concentrate oil content.

In India, the copra drying is a serious problem with smallholders in rural areas; they resort to drying by either kiln or sun drying. Both these methods of drying have adverse effects on the copra quality. Sun drying takes about 7 days depending on the availability of sun and if the weather is rainy the copra produced will be contaminated with fungi which produce a grey rancid product. Furthermore sun drying requires more space, labour intensive and there can be deteriorations in quality from deposits of dirt and dust. Also microorganisms can increase the acid content, cause rancidity and reduce the amount of extractable oil resulting in low quality coconut oil. During monsoon, drying by artificial method (kiln drying) is the only solution for copra making. In kiln drying, smoke will be in direct contact with coconut cups. Hence, high quality copra could not be produced due to formation of high acid content and polycyclic aromatic hydrocarbons in the copra (Thiruchelvam et al., 2007).

Several experimental and theoretical studies have been reported in the development of various types of driers for drying agricultural products (Kadam & Samuel, 2006; Shanmugam & Natarajan, 2006; Ivanova and Andonov, 2001). Since drying temperature is an important aspect of processing quality copra, a cabinet drying study was conducted at

different drying temperatures to optimize the drying temperature to produce copra with good quality

MATERIALS AND METHODS

Experiments were conducted in food processing laboratory, TNAU, India. Matured and good quality nuts were split into two halves crosswise to remove coconut water. Broken coconuts along with shell were loaded over trays of drier unit. Then, exhaust fan was switched on to exhaust initial high humid air. Moisture content was measured every 1 h interval till end of drying. After attaining 40% moisture content, copra kernels were scooped from shells and dried further to reach final moisture content of 7%. Finally, copra was graded according to BIS: 6220 – 1971.

Moisture Content Determination

Samples (10 g) were chopped from randomly selected 5 cups and kept in a convective electrical oven, maintained at 105 ± 1°C for 5 h. initial (m_i) and final mass (m_f) at time t of samples were recorded using electronic balance and repeated every 1 h interval till end of drying. Moisture content on wet basis is defined as

$$M_{wb} = (m_i - m_f)/ m_i \qquad \text{………………} (1)$$

Where, m_i and m_f are initial and final weight of samples respectively.

Grading of Copra

Grading of copra was done after drying according to BIS: 6220 – 1971 by randomly selecting 50 cups. Chips in bulk sample were separated and weighed (% by wt). Wrinkled cups were separated and calculated their number as percentage of cups constituting bulk sample. Number of mouldy and black cups were counted and reported as percentage. FFA was determined in oil extract by international method (AACC, 1990). The specific gravity, peroxide value and iodine vaue of oil was estimated by AOAC, (1980).

RESULTS AND DISCUSSIONS

Drying Time of Copra

The drying temperature of 90°C took only 12 h to reach the desired moisture content, whereas the drying time was 15 h at 80°C. For the drying temperatures 60 and 70°C the drying was 42 h and 24 h respectively to attain the desired moisture content of 6.1 % (w.b). The copra dried at higher temperature is 3 times faster than sun dried copra (105 h). The higher temperatures 90 and 80°C took a maximum of 15 h to dry the copra but with a poor quality cups (Figure 1).

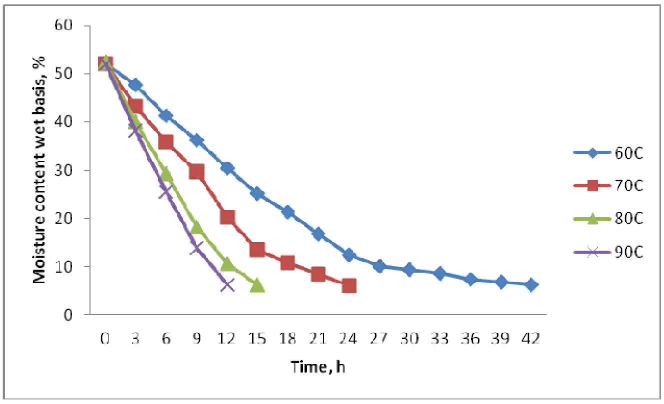

Figure 1: Variation of Moisture Content with Time

Quality of Dried Copra

The quality of the dried copra was compared with sun dried copra and is presented in the Table 1. The impurities percentage were recorded as 1, 0.5, 0.5 and 1 at 60, 70, 80 and 90^{o}C but it was very high (9%) in sun dried copra, this was due to the exposure of sun dried cups to dust, birds etc. The percentage of mouldy cups were found to be more in copra dried at 60^{o}C (5 %) and less at 90^{o}C (2 %) whereas sun dried cups had 25% because of exposure of cups to climate fluctuations and improper drying. This high value is due to the long drying time to attain the desired moisture content (Figure 2).

Figure 2: Comparison of Sun Dried and Cabinet Dried Copra at 70 ^{O}c

The percentage of black cups and wrinkled cups were high at 90^{o}C (8%) followed by 80^{o}C (7 %) and low in copra dried at 60 and 70^{o}C (2 – 3 %) but it was 2% in sun dried copra. The high value of the coconut cups might be due to the exposure of copra at high temperatures. The chips percentage was recorded as 1, 3, 7, 9 and 1 % for copra dried at 60, 70, 80, 90^{o}C and by sun drying. This increase in percentage chips was due to increase in drying air temperature, which caused the case hardening of copra samples leading them to broken pieces.

The moisture content of the coconut samples were recorded in the range of 6 to 7 % (w.b) at all drying temperatures. The coconut kernel under sun drying had a moisture content of 7%. The moisture content which is often used as an index of stability and quality as well as a measure of yield and quantity of solid food is generally lower for dry nuts. This is suitable compared with the result obtained by various workers (6 -8 % w.b) in fully dried nuts (Johnson, 1987).

The coconut dried at 70^{o}C recovered the maximum oil content of 67.1 % followed by 60^{o}C drying temperature of 65.27 % oil content, whereas at 80 and 90^{o}C the samples contained the minimum oil content of 42.7 % and 40.1 %. The oil content of 63.1% was recorded in sun dried copra. This reduction in oil content at higher temperatures was due to case hardening of the samples. These results showed a close range with that of Priscilla (1989) were the dried coconuts contain oil content of 75.0±0.10%.

Table 1: Copra Quality at Different Drying Temperatures

Characteristics	60^{o}C	70^{o}C	80^{o}C	90^{o}C	Sun dried copra
Impurities, % by wt, Max	1	0.5	0.5	1	9
Mouldy cups, % by count, Max	5	2	2	2	25
Black cups, % by count, Max	3	2	7	8	2
Wrinkled cups, % by count	2	2	7	8	2
Chips, % by wt, Max	1	3	7	9	1
Moisture content % by wt, Max	6.2	6.51	6.34	6.42	7
Oil content (on moisture free basis), % by wt, Min	65.27	67.1	42.7	40.1	63.1
FFA	0.5	0.5	0.8	0.9	0.8
Peroxide value, meq/kg	2	2	7	10	8
Specific gravity	0.93	0.92	0.90	0.89	0.93
Iodine value	8.1	8.2	8.5	8.9	8.7

(n=3) – no. of replications

The FFA of the dried samples was found to be 0.5 at 60 and 70°C but it was high in samples dried at higher temperatures of 80 and 90°C (0.8 and 0.9) whereas the sun dried copra had a value of 0.8 which was due to contaminated cups. This was because the exposure of samples at higher temperatures caused excessive browning and oxidation (Guarte, 1996).

The peroxide value of the extracted oil was found to be high at 90°C with the value of 10 meq/kg (high oxidation), medium at 80°C with the value of 7 meq/kg (moderate oxidation) and lower values of 2 meq/kg at 60 and 70°C (low oxidation) but in sun dried copra it was 8 meq/kg. Similarly, Atasie *et al.,* (2009) reported the acid value of groundnut oil was 4 - 9 meq/kg which was far below the maximum limits of edible oils (15 meq/kg).

The specific gravity of the extracted oil decreases with increase in temperature and the values were measured as 0.93, 0.92, 0.90 and 0.89 at 60, 70, 80 and 90°C respectively and it was 0.93 in sun dried samples. This is comparable to that of early workers (Pearson, 1976). But the iodine value of the extracted oil increases with increase in temperature and the values were found to be 8.1, 8.2, 8.5 and 8.9 at 60, 70**,** 80 and 90°C respectively. The sun dried samples had an iodine value of 8.7. This was because the saturated oil becomes unsaturated at higher temperatures. Oils react with water and air to form polymers (plastics) at high temperatures. This tendency is defined by the Iodine value of the oil. Coconut oil has the smallest iodine value among all the vegetable oils which makes it a better fuel. For the same reason, to maintain and preserve oil quality, it is advisable to keep it in cool temperatures and in airtight containers flushed with nitrogen (Kaul *et al.*, 2009).

As per BIS standards of grading copra, the best quality copra was obtained at the drying temperature of 70°C with the percentage of impurities, mouldy cups, black cups, wrinkled cups, chips, oil content, moisture content as 0.5, 2, 2, 2, 3, 67.1, 6.51 and the values of FFA, specific gravity, iodine value, acid value of extracted oil were 0.5, 0.92, 8.2 and 2 respectively.

CONCLUSIONS

This study was conducted to help diversify the uses of coconut drying technology and accordingly, increase their profitability by drying coconut kernel during monsoon within a short duration. The results showed that the quality of coconut kernel can be effectively obtained by drying at a higher temperature. This technology will be more helpful for the industrialist and small scale farmers to dry the copra in a short time with good quality nuts.

In conclusion, the obtained findings will contribute to better valorisation of copra traders and help in the creation of profitable coconut transformation utilities.

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